Reviews in Environmental Health, 2000

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As we move into the next millennium, the importance of environmental health issues escalates. While humans always had an impact on their environment, the destructive impact began to mount with the advent of the Industrial Revolution and continued throughout the 19th century. As the 20th century comes to a close, soaring world population, overconsumption, and waste production have led to an enormous number of anthropogenic toxicants causing widespread environmental pollution of land, water, and air.

The issue of environmental degradation and its effects on human health was slow to reach the world's conscience. A major step in addressing the degradation occurred in 1972 when the United Nations General Assembly organized the United Nations Conference on the Human Environment in Stockholm. This led to the creation of the United Nations Environment Programme (UNEP), which attempts to solve many problems, including cleaning up the Mediterranean; protecting water resources; combating deforestation, desertification, and drought; and phasing out the production of ozone-depleting chemicals.

Numerous people helped bring about this general awareness of environmental issues, for example, Rachel Carson, who is perhaps the best known of the early environmental prophets. Another person who deserves recognition is the late Dr. David P. Rall, second director of NIEHS (1971–1990) and the founder of the journal *Environmental Health Perspectives*. His powerful voice helped to educate the world and to muster the needed governmental forces critical for addressing environmental health issues.

The growing awareness of the problem culminated in the convening of the Earth Summit in Rio de Janeiro, Brazil, in 1992. This meeting was attended by nearly 30,000 people from around the world, including more than a hundred world leaders and representatives from 167 countries. The goal of the summit was to address troubling symptoms of environmental decline. One important accomplishment of the Summit was the signing of the Framework Convention on Climate Change. Five years later in Kyoto, Japan, an agreement (Kyoto Protocol) was reached that limits greenhouse gas emissions by developed countries.

Although there is disappointment with the progress to protect the environment, there is a growing awareness of the impact that a polluted environment can have on our health and well-being. But how much is truly understood by the public? Surveys suggest that there is much work ahead, as the American public consistently receives failing grades in basic environmental knowledge. Green education continues to be an important need.

This year *Environmental Health Perspectives* continues its tradition of publishing a supplement containing review papers spanning a wide range of topics in environmental health. The objectives of these reviews are to summarize new developments in environmentally relevant areas, to provide a perspective for these new findings, and to provide sufficient background information for those not familiar with the specific topic. Selected topics for this edition are environmental disease mechanisms, toxicology, nonionizing radiation, global ecologic issues, and public health issues.

Environmental Disease Mechanisms

To properly address the deleterious effects of environmental pollutants, we must understand the underlying mechanisms. The phenomenon of genetic imprinting during embryonic development was first reported 40 years ago. Subsequently, imprinting has been hypothesized to play an important role in regulating the rate of fetal growth and behavioral development and has been associated with numerous human genetic disorders including cancer. This imprinting process is a chemical or structural change established during germ-cell development to distinguish between paternal and maternal copies of the imprinted genes. Genomic imprinting is profoundly important in controlling gene expression and may be a target for environmental toxicants.

In a 1997 Executive order, U.S. federal agencies were charged to consider special environmental risks posed to children. The National Institute of Environmental Health Sciences along with the U.S. Environmental Protection Agency and the U.S. Centers for Disease Control and Prevention responded by establishing a new program to foster research in this area by sponsoring research centers focusing on environmental health issues. Half of the June 1999 *EHP Supplement* was devoted to this topic. The director of one of the centers that was not included in that Supplement was asked to provide a review on the unique susceptibility of children to environmental toxicants. The resulting paper provides examples of mechanisms of susceptibility relevant for toxicity assessment and examples of exposure factors that help define this susceptibility.

The general question about the role genetic variability in determining an individual's susceptibility to environmental factors is a relatively new area of research that has recently received increasing attention, especially by the Environmental Genome Project at the National Institute of Environmental Health Sciences. Lead exposure is just one example of a major environmental problem that persists and in which genetic variability is important. All individuals do not have the same

vulnerability to lead intoxication. One of the reviews in this issue considers evidence that genetic variations may alter lead distribution and toxicity in humans. Current results suggest that ALAD2 (aminolevulinic acid dehydratase—an enzyme of heme biosynthesis) is actually protective of the toxic effects of lead although some consider the case for the involvement of *ALAD* polymorphism to be weak.

Toxicology

In our 1998 review issue, we included an evaluation of the effects of micronutrients on metal toxicity. That theme is continued in a review paper this year that examines the influence of nutrition on methyl mercury intoxication. One of our expert reviewers who recommended publication stated that because of the

> increases in inorganic mercury in the hydrosphere and biosphere due to acid rain and industrial mining activities and, the subsequent biomethylation, the global exposure to methylmercury in the 21st century is expected to increase. Therefore methylmercury is becoming a global environmental health concern.

The authors of this article suggest that the inconsistency of the methyl mercury toxicity observed in different populations is related to possible effects of dietary modulation.

An *EHP* Editorial Board member provided a useful and current review of molecular epidemiologic studies in the context of occupational and environmental exposures. The paper is a extensive and detailed summary of a new area of research that combines laboratory measurement of internal dose, biologic effects, and influence of individual susceptibility with epidemiologic methodologies.

Nonionizing Radiation

Stratospheric ozone depletion has raised the level of concern over the effects of ultraviolet (UV) radiation exposure. Because of this concern, sunscreen products have found wide acceptance. Thus, a timely review was solicited that addressed the efficacy question. The author notes that sunscreens are tested for their ability to prevent erythema from UVB exposure, but no sunscreen prevents photodamage (DNA damage and skin immune system changes). There is no uniformly accepted method for evaluation of UVA protection. Information gaps include the photobiology of UVA radiation, the need for establishment of testable biologic end points, and the importance of UVA protection afforded by sunscreens.

Potential health effects from exposure to magnetic fields have received much scrutiny. Because of the high visibility and importance of this area of research, a comprehensive review of all animal studies attempting to assess the potential carcinogenic activity of magnetic fields was selected for inclusion. Although these authors conclude that it is unlikely these exposures cause cancer, many other reputable scientists remain concerned, so this issue will be with us for some time.

Public Health Issues

Hazardous waste landfill sites although necessary in our society are spurned by most communities. Review of the epidemiologic literature led to the conclusion that there may be risks to occupants of residences near hazardous waste landfill sites but that further research is needed, especially measurement of direct exposures.

Drinking water treatment is one of the most critical issues in public health. Removal of cyanobacterial toxins and the organisms that produce them is especially difficult. In a solicited review, the author provides a thorough analysis of treatment technologies for the control and removal of cyanobacteria (blue-green algae) and their toxins from drinking water supplies. Ozonation of water is emphasized. Effects of the toxins range from liver damage to neurotoxicity.

Noise appears to be an unavoidable evil of modernity. But are there health effects besides the problem of hearing loss? The answer to this question can have significant financial consequences such as in decisions on placement of airports, freeways, noisy factories, etc. Therefore, we decided that a review in this area was pertinent. There appears to be sufficient evidence that noise exposure can induce hearing impairment, hypertension and ischemic heart disease, annoyance, sleep disturbance, and decreased school performance. Evidence for other effects such as changes on the immune system and birth defects is limited.

Global Ecologic Issues

Global warming has been blamed for a number of ecologic disturbances. One such disturbance is the frequency of toxic algal incidents. These incidents have increased worldwide as have the incidents of human intoxication from algal toxins. The current review summarizes the origins and health effects of marine algal toxins as well as changes in their current global distribution and then examines possible causes for the recent increases in their occurrence.

The use of a canary as a sentinel for "good air" in the mines was a frequent practice in previous times. Do the mass die-offs of amphibians present themselves as possible sentinels of other environmental hazards to which we should not turn a blind eye? In this review, the author finds that infectious disease appears to be the direct cause of mass amphibian deaths in primarily undisturbed areas of the world where anthropomorphic environmental disruption is minimal. So why the increase in amphibians deaths from infectious agents? There is no concrete answer. Possibilities include the natural evolution of new pathogens, environmental change that promote the emergence of pathogenic forms, or environmental change that weakens their immune system.

Review articles continue to be an important part of *EHP* as we further develop and add value to the Journal. It is with these articles that environmental scientists can build onto their intellectual underpinnings so they are able to stay abreast of new and blossoming fields.